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Indian Standard

SPECIFICATION FOR PLASTIC FILM DIELECTRIC VARIABLE TUNING CAPACITORS GRADE 2

PART I TESTS AND GENERAL REQUIREMENTS

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SPECIFICATION FOR PLASTIC FILM DIELECTRIC VARIABLE TUNING CAPACITORS GRADE 2

PART I TESTS AND GENERAL REQUIREMENTS

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Indian Standard

SPECIFICATION FOR PLASTIC FILM DIELECTRIC VARIABLE TUNING CAPACITORS GRADE 2

PART I TESTS AND GENERAL REQUIREMENTS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 12 August 1980, after the draft finalized by the Capacitors Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The object of this standard is to establish uniform requirements for judging the mechanical, electrical and environmental properties of plastic film variable tuning capacitors, the capacitance of which is likely to be frequently varied throughout its useful life.

0.3 This standard requires reference to IS : 7748 (Part I)-1975* in which details of various tests prescribed, have been fully covered. Only the appropriate degrees of severity and any other special conditions relating to certain tests have been included in this standard.

0.4 This standard is largely based on IEC Pub 418-2 (1976) 'Variable Capacitors : Part 2 Type Specification for variable capacitors Type A' issued by International Electrotechnical Commission.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part I) covers tests and general requirements relating to plastic film dielectric variable tuning capacitors (Grade 2) mostly used in domestic electronic equipment.

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*Specification for variable capacitors : Part I Tests and general requirements.

†Rules for rounding off numerical values (*revised*).

1.1.1 The general requirements and tests described in this standard are applicable to each section of multi-section capacitors, unless otherwise specified in the detail specification.

1.1.2 This standard may also be applied to plastic film dielectric tuning capacitors fitted with trimmers.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 7748 (Part I)-1975* shall apply.

3. DESCRIPTIVE CODE

3.1 The description of the type (function), dielectric, style and application (grade) of these types of capacitors, shall be in accordance with **3.1** of IS : 7748 (Part I)-1975*.

4. CLIMATIC CATEGORIES

4.1 The preferred climatic categories are:

Climatic Test	*Severities*		
[*see* IS : 9000 (Part I)-1977†]	Category 2A	Category 2B	Category 3
Dry heat	+ 70°C	+ 70°C	+ 55°C
Cold	– 25°C	– 10°C	– 10°C
Damp heat (long term)	21 days	21 days	10 days
Damp heat (accelerated)	2 cycles	2 cycles	1 cycle
Rapid change of temperature	+70° to – 25°C	+70°to – 10°C	—
Low air pressure	30 kPa	30 kPa	—

5. CONSTRUCTION AND WORKMANSHIP

5.1 Provisions of **5** of IS : 7748 (Part I)-1975* shall apply.

6. RATINGS

6.1 Nominal Capacitance — This value shall be specified in the relevant detail specification and shall comprise of the following:

a) Capacitance swing (nominal), and
b) Minimum capacitance (nominal).

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*Specification for variable capacitors : Part I Tests and general requirements.

†Basic environmental testing procedures for electronic and electrical items : Part I General.

6.2 Rated Voltage — The rated voltages shall be selected from the R5 series (*see* IS : 1076-1967*) and where intermediate values are required, these shall be chosen from the R10 series.

6.3 Capacitance Law — This shall be specified in the relevant detail specification.

7. MARKING

7.1 The following marking information in the order given below is required:

- a) Minimum capacitance and capacitance swing;
- b) Rated voltage;
- c) Manufacturer's name or trade-mark; and
- d) Week (or month) and year of manufacture, this may be in coded form as given in IS : 8186-1976†.

7.1.1 The capacitors shall be clearly marked with items (a) and (b) of **7.1** and with as many as possible of the remaining items as are considered useful.

7.1.2 The package containing the capacitor(s) shall be clearly marked with all the information listed above.

7.1.3 Any other marking as agreed upon between the manufacturer and the purchaser.

7.2 The capacitors may also be marked with the ISI Certification Mark.

Note — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. GENERAL CONDITIONS FOR TESTS

8.1 General conditions for tests shall be as specified in **8** of IS : 7748 (Part I)-1975‡ with the following details:

- a) Method A shall be used for all tests for measurements where capacitors have to be mounted, unless otherwise specified.

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*Preferred numbers.

†Marking codes for values and tolerances of resistors and capacitors.

‡Specification for variable capacitors : Part I Tests and general requirements.

b) For capacitors fitted with trimmers, the trimmers shall be set at minimum capacitance position for all tests.

9. CLASSIFICATION OF TESTS

9.1 Type Tests — The schedule for type tests shall be in accordance with Table 1.

TABLE 1 SCHEDULE OF TYPE TESTS

GROUP (1)	TEST (2)	NUMBER OF SAMPLES (3)
0	Visual examination Dimensions and effective angle of rotation Capacitance Tangent of loss angle Voltage proof Insulation resistance Operating torque Rotor contact resistance Sealing (normal conditioning) (where applicable)	35 or 30 depending upon whether electrical endurance test is to be carried out or not
1	Backlash Locking (if applicable) Locking proof torque (if applicable) End stop torque Thrust and pull (axial) Side thrust Robustness of terminations Solderability Vibration Rapid change of temperature Climatic sequence	10
2	Damp heat (long term)	5
3	*Endurance* :	
	a) Mechanical endurance	5
	b) Electrical endurance	5 (wherever required)
4	Resistance to soldering heat	5
5	Temperature coefficient Capacitance drift Salt mist	5

9.1.1 *Number of Samples* — The number of samples required for type tests shall be 35 or 30 in each type depending upon whether electrical endurance test is to be performed or not.

NOTE — Capacitors which have been subjected to type tests shall not be used in equipment or returned to bulk supply.

9.1.2 *Criteria of Approval* — There shall be no single failure in the type tests.

9.2 Routine Tests — The following tests shall be carried out on each and every capacitor:

a) Visual examination,
b) Voltage proof (high voltage) (as a flash test), and
c) Capacitance.

9.3 Acceptance Tests — From the lot which has passed the routine tests, two groups of samples (Group A and Group B) shall be selected and the capacitors shall be subjected to the tests in the order given in Table 2.

TABLE 2 SCHEDULE OF ACCEPTANCE TESTS

TEST	CLAUSE REF	AQL (DEFECTIVE)	INSPECTION LEVEL	D/ND
(1)	(2)	(3)	(4)	(5)
Group A		1 percent	II	ND
Dimensions	12.2			
Tangent of loss angle operating torque	11.3			
Insulation resistance	11.5			
Group B				
Sub-group B1		4 percent	S3	D
Solderability	12.11			
Robustness of trimmations	12.9			
Climatic	13			
Sub-group B2		4 percent	S3	ND
Temperature coefficient	11.7			

D=Destructive ND=Non-destructive

10. GENERAL TESTS

10.1 Provisions of **8** of IS : 7748 (Part I)-1975* shall apply.

11. ELECTRICAL TESTS

11.1 Capacitance — The provisions of **11** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) *Capacitance measurement* — The capacitors shall be mounted by using Method C of **8.6** of IS : 7748 (Part I)-1975*. The capacitance shall be measured at a frequency of 800-1200 kHz or at any other frequency, specified in the detail specification.

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*Specification for variable capacitors : Part I Tests and general requirements.

b) The minimum and maximum capacitances and the capacitance law shall be measured at the measuring angles specified in the detail specification.

c) Where coupling capacitance is applicable, the limits of coupling and the sections between which it is to be measured, shall be specified in the detail specification.

11.2 Capacitance Drift After Adjustment — Provisions of **11.2** of IS : 7748 (Part I)-1975* shall apply.

11.3 Tangent of Loss Angle — Provisions of **11.3** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) Measurement conditions and tan δ value shall be as follows:

Capacitance Swing	*Measurement conditions*		*Tan δ*
	Capacitance (pF)	Frequency (MHz)	
>30 pF	Maximum and minimum capacitance	1	3×10^{-3}
$\leqslant 30$ pF	10 pF or at maximum capacitance whichever is the lower	100	6×10^{-3}

11.4 Voltage Proof — Provisions of **11.4** of IS : 7748 (Part I)-1975* shall applly, with the following details:

a) Test voltage : $2U_R$, and

b) Points of application of test voltage : between parts which are insulated from each other.

11.4.1 If breakdown occurs, the capacitor shall not be used for further tests.

11.4.2 when rotating the rotor while the voltage is applied, care should be taken to avoid making contact between an uninsulated rotor tie-bar and the stator.

11.5 Insulation Resistance — The provisions of **11.5** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) Position of rotor: set at minimum and maximum capacitance position, and

b) Minimum value of insulation resistor: 10 000M Ω.

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*Specification for variable capacitors : Part I Tests and general requirements.

11.6 Rotor Contact Resistance — Provisions of **11.6** of IS : 7748 (Part I)-1975* shall apply. Value of rotor contact resistance shall not exceed 10 MΩ.

11.7 Temperature Coefficient — Provisions of **11.7** of IS : 7748 (Part I)-1975* shall apply.

The value shall be as specified in the detail specification.

11.8 Capacitance Drift — Provisions of **11.8** of IS : 7748 (Part I)-1975* shall apply.

The value of capacitance drift shall be as specified in the detail specification.

12. MECHANICAL TESTS

12.1 Visual Examination — Provisions of **12.1** of IS : 7748 (Part I)-1975* shall apply.

12.2 Dimensions and Effective Angle of Rotation — Provisions of **12.2** of IS : 7748 (Part I)-1975* shall apply.

12.3 Operating Torque — Provisions of **12.3** of IS : 7748 (Part I)-1975* shall apply.

The value of the operating torque shall be as specified in the detail specification, keeping in mind that the ratio of the maximum to minimum torque shall not be more than 3.

12.4 Locking (For Capacitors Fitted with Integral Locking Device only) — Provisions of **12.4** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) *Locking torque* — as specified in detail specification,
b) *Limit of capacitance change after locking* — shall not exceed 1·0 percent or 0·2 pF, whichever is greater,
c) *Torque applied to the locked actuating device* — as specified in the detail specification, and
d) *Change in capacitance* — shall not exceed 0·2 percent or 0·2 pF, whichever is greater, after application of torque.

12.5 Locking Torque Proof (For Capacitors Fitted with Integral Locking Device only) — Provisions of **12.5** of IS : 7748 (Part I)-1975* shall apply.

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*Specification for variable capacitors : Part I Tests and general requirements.

12.6 End Stop Torque (For Capacitors Fitted with End Stops only)— Provisions of **12.6** of IS : 7748 (Part I)-1975* shall apply, with the following details:

a) Applied torque — 0·75 Nm; and

b) If a rotor tie-bar is to be tested as an end stop or if a capacitor with a reduction gear greater than 1·5 is to be tested, the applied torque shall be 0·25 Nm.

12.7 Thrust and Pull (Axial) — Provisions of **12.7** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) Thrust for capacitance change — 10 N,

b) Maximum permissible pull — 30 N, and

c) Capacitance change — shall not exceed after releasing applied load:

for capacitance > 30 pF — 1 percent or 1 pF whichever is greater

for capacitance $\leqslant 30$ pF — 0·2 pF.

12.8 Side Thrust — Provisions of **12.8** of IS : 7748 (Part I)-1975* shall apply, with the following details:

a) Applied thrust — 10 N,

b) Point of application — 5 mm from the bearing face, and

c) Maximum permitted capacitance change after releasing applied load:

for capacitance > 30 pF — 1 percent or 1 pF whichever is greater

for capacitance $\leqslant 30$ pF — 0·2 pF.

12.9 Robustness of Terminations — Provisions of **12.9** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) The limit for capacitance change shall be 1 percent, and

b) Pull for tensile test — 5 N.

12.10 Backlash (Not Applicable to Capacitors without Reduction Gear) — Provisions of **12.10** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) Method of mounting — Method C of **3.6** of IS : 7748 (Part I)-1975*.

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12.11 Soldering — Provisions of **12.11** of IS : 7748 (Part I)-1975* shall apply.

12.12 Vibration — Provisions of **12.14** of IS : 7748 (Part I)-1975* shall apply with the following details:

a) Method of mounting — method C of **8.6** of IS : 7748 (Part I)-1975*,

b) Frequency — 10-55 Hz,

c) Amplitude — 0·35 mm,

d) Duration — 90 min (30 min for each plane), and

e) Limit for capacitance change and rate of leakage of air for sealed capacitors, shall be specified in detail specification.

12.13 Sealing (Normal Conditioning) (where Applicable) — Provisions of **12.16** of IS : 7748 (Part I)-1975* shall apply.

13. CLIMATIC TESTS

13.1 Climatic Sequence — Provisions of **13.1** of IS : 7748 (Part I)-1975* shall apply.

13.1.1 *Initial Measurements* — The capacitance shall be measured.

13.1.2 *Dry Heat* — Provisions of **13.1.2** of IS : 7748 (Part I)-1975* shall apply.

13.1.3 *Damp Heat (Accelerated) First Cycle* — Provisions of **13.1.3** of IS : 7748 (Part I)-1975* shall apply.

13.1.4 *Cold* — Provisions of **13.1.4** of IS : 7748 (Part I)-1975* shall apply.

13.1.5 *Low Air Pressure* — Provisions of **13.1.5** of IS : 7748 (Part I)-1975* shall apply.

13.1.6 *Damp Heat (Accelerated) Remaining Cycles* — Provisions of **13.1.6** of IS : 7748 (Part I)-1975* shall apply.

13.1.7 *Final Measurements* — After standard recovery, the capacitors shall be subjected to the tests as specified in **13.1.6.2** of IS : 7748 (Part I)-1975* with the following additional detail:

> The rotor shall be set and maintained throughout the test in a position at near maximum capacitance.

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*Specification for variable capacitors: Part I Tests and general requirements.

13.2 Damp Heat (Long Term Exposure) — Provisions of **13.2** of IS : 7748 (Part I)-1975* shall apply with the following detail:

> The rotor shall be set and maintained throughout the test in a position at near maximum capacitance.

14. SALT MIST

14.1 The provisions of **14** of IS : 7748 (Part I)-1975* shall apply.

15. ENDURANCE

15.1 Mechanical Endurance — Provisions of **16.1** of IS : 7748 (Part I)-1975* shall apply, with the following details:

a) Capacitors fitted with locking devices shall be locked and unlocked the number of times specified in the detail specification.
b) Rate of operation of rotor shaft — 10 to 15 cycles per minute.
c) Number of cycles — 10 000 cycles.
d) Final measurements operating torque shall not be less than 50 percent of the minimum value and not more than 150 percent of the maximum value, specified in **12.3**.

15.2 Electrical Endurance (where Applicable) — Provisions of **16.2** of IS : 7748 (Part I)-1975* shall apply with following detail:

> The capacitors shall be subjected to the upper category temperature for 1 000 h with the test voltage continuously applied.

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*Specification for variable capacitors : Part I Tests and general requirements.